EDWARD H. RICHARDSON ASSOCIATES, INC.
CONSULTING ENGINEERS
63 NORTH DU PONT HIGHWAY • DOVER • DELAWARE
MAIL ADDRESS: P.O. BOX 935 • DOVER • DELAWARE 19901 • PHONE (302) 674-3838

November 30, 1971

Mr. Frank Landa, General Manager
Woodlawn Gravel Company
P.O. Box 2501
Wilmington, Delaware 19805

Dear Mr. Landa:

We elected not to duplicate the analytical work conducted by Dr. Larry L. Olson, which clearly shows the extent of the bacteria problem. Our work was directed primarily at the "black "water problem.

Our analyses of the fresh water pond - clear (sample taken 10/28/71 Lab sample No.1621) and "black" (sample taken 11/1/71 Lab sample No. 1617) are summarized in the attached laboratory report. In essence, the black material is suspended in the fresh water pond. The black flake-like particles appear to be what a colleague of ours calls "juice". This septic sewage-like material is not water soluble and represents only 22 mg/l (22 pounds of material per 120,000 gallons of water). It is readily removed by filtering or long term settling. This accounts for your ability to remove the black color by recirculating the "fresh" water through your settling ponds. As the combination of slow settling and filtration will remove the color.

We cannot identify the composition of the "juice" except to state that it is a very complex organic mixture, most probably derived from the putrefaction of the garbage in the landfill. All of the black "juice" gathered in the landfill area, appear to be similiar to each other and to the black suspended material in the "fresh" water pond.

We examined the samples taken from the fresh water pond for several heavy metals (filtered and unfiltered) to check for metal content in the system. These analyses also show the suspended material to be essentially organic in composition.

Because this "juice" is insoluble in water, it is difficult to see how it can be transported any distance, through the soil, unless it is of such chemical composition which becomes water insoluble upon exposure to the air. The flake-like appearance of the particles tends to indicate they came from the black films which are visible seeping out of the landfill. A heavy rain will mechanically break up the black film, forming the suspended particles which are washed to the lower pond (fresh water pond). Further, a heavy rain could agitate the pond to re-suspend the particles which have settled on the bottom. It is possible, the upper ponds do not suffer from this re-agitation/suspension phenomina because the black flakes have been covered by the settled soil/clay during the normal operation of the pond system.

The actual mechanism whereby the black particles are introduced to the "fresh" water pond can be resolved by sampling of the area during a hard rain. The black flakes should be visible in samples taken from the ditches leading to the lower pond area. Further, the actual break-up and suspension of one of the black seepage films could be observed.

When the method or methods of contamination have been firmly established, a prevention program can be worked out. We can arrange to furnish a sampling crew to conduct the rain observations if you so desire. A meeting with you and Mr. Ward might be fruitful. Our Mr. Dudley Willis is a knowledgeable engineer with considerable current experience with landfill operation and has been responsible for the operation of a sand/gravel pit. We appreciate this opportunity to be of service to you, should you desire additional information, please let us know.

Very truly yours,

EDWARD H. RICHARDSON ASSOCIATES,INC.
Environmental Sciences Laboratory

Logan N. Miller

Logan N. Miller, Branch Manager

LVM/bll
Encl.

028241

A 33 000374

EDWARD H. RICHARDSON ASSOCIATES, INC.
ENVIRONMENTAL SCIENCES LABORATORY
P. O. BOX 935 PHONE 302-674-3030
63 N. DUPONT HIGHWAY DOVER, DELAWARE 19901

CLIENT: Woodlawn Gravel Company
ADDRESS: P.O.Box 2501, Wilmington, Delaware 19805
REQUESTED BY: Mr. Frank Landa, General Manager
SAMPLED BY: Logan Miller & James Melvin of EHR
NOTES ON SAMPLING (MODE, TEMP., FLOW, ETC.):

COMM. NO. 5066
PHONE 328-1040
DATE RECEIVED See below
DATE SAMPLED See below

LABORATORY ANALYSIS REPORT (PAGE 1 OF 2)

SAMPLE NUMBER	SAMPLE DESCRIPTION
1 1617	Fresh Water Pond-Sampled 11/1/71
2 1617F	Same as above after filtration Sampled 11/1/71
3 1621	Fresh Water Pond-Sampled 10/28/71
4 1660	Red Lion Creek at Pt 13-Sampled 11/16/71
5	
6	

(A) RESULTS OF WASTE ANALYSES

SAMPLE NUMBER	1617	1617F	1621	1660		
pH, UNITS						
BOD_5, mg/l						
COD, mg/l						
TOTAL PHOSPHATE, mg/l, PO_4						
ORTHO PHOSPHATE, mg/l, PO_4						
PHENOL, mg/l						
OIL AND GREASE, mg/l						
MBAS DETERGENT, mg/l						
SULFATES, mg/l						
SULFIDES, mg/l						
FLUORIDES, mg/l						
CYANIDE, mg/l						
SILICA, mg/l						

(B) RESULTS OF METAL ANALYSES

ARSENIC, mg/l	<0.1	<0.1	<0.1	<0.1		
CADMIUM, mg/l	<0.1	<0.1	<0.1	0.02		
CHROMIUM, mg/l	0.15	0.15	0.1	0.10		
COBALT, mg/l	<0.1	<0.1	<0.1	0.05		
COPPER, mg/l	<0.1	<0.1	<0.1	0.05		
IRON, mg/l	12.9	11.6	8.1	1.8		
LEAD, mg/l	0.18	0.18	<0.1	0.1		
MAGNESIUM, mg/l						
MANGANESE, mg/l	8.0	7.7	3.96	0.36		
MERCURY, mg/l						
NICKEL, mg/l	0.11	<0.1	<0.1	0.08		
ZINC, mg/l	<0.1	<0.1	0.18	0.12		

028242

000375

LABORATORY ANALYSIS REPORT (PAGE 2 OF 2)

(C) RESULTS OF BACTERIOLOGICAL ANALYSES.

SAMPLE NUMBER —	1617	1621				
TOTAL COLIFORM, #/100 ml						
FECAL COLIFORM, #/100 ml						
FECAL STREPTOCOCCI, #/100 ml						

(D) RESULTS OF MINERAL ANALYSES

ACIDITY, mg/l, $CaCO_3$						
ALKALINITY, mg/l, $CaCO_3$						
CALCIUM, mg/l						
CARBON DIOXIDE, mg/l, CO_2						
CHLORIDE, mg/l, Cl						
CONDUCTIVITY, MICROMHOS/cm						
HARDNESS, mg/l $CaCO_3$						

(E) RESULTS OF PHYSICAL ANALYSES

COLOR, UNITS						
TURBIDITY, JTU						
ODOR						
DISSOLVED OXYGEN, mg/l						
TEMPERATURE, °C.						
% OXYGEN SATURATION						

(F) SOLIDS BALANCE ANALYSES

SETTLEABLE SOLIDS, ml/l						
TOTAL SUSPENDED SOLIDS, mg/l	50	63				
NON VOL. SUSPENDED SOLIDS, mg/l	28	23				
VOL. SUSPENDED SOLIDS, mg/l	22	40				
TOTAL SOLIDS, mg/l	519	450				
NON VOL. TOTAL SOLIDS, mg/l	246	220				
VOLATILE TOTAL SOLIDS, mg/l	273	230				

(G) NITROGEN BALANCE, mg/l as N

TOTAL KJELDAHL NITROGEN						
ORGANIC NITROGEN						
AMMONIA NITROGEN						
NITRITE NITROGEN						
NITRATE + NITRITE NITROGEN						

(H) MISCELLANEOUS ANALYSES

REMARKS: 000376 928243

DELIVER TO: MAIL ☐ TELEPHONE ☐

ESL NO. 6-1: 61571: 2 of 2

LABORATORY MANAGER